

COOP Modernization Partner's Forum
September 18, 2002
Rockville, Maryland

MEETING SUMMARY

Introduction

Meeting Chair: Mr. Gregory A. Mandt, Director, NWS Office of Climate, Water, and Weather Services

The COOP network is one of our nation's true treasures. This meeting is about partnerships, about all of us coming together to make this modernization happen in our life times. During the course of this meeting, each participant should ask himself, "What can I do to make this happen?" and everyone should leave with an individual action plan.

Welcome/Objectives

Dr. James R. Mahoney, Assistant Secretary of Commerce for Oceans and Atmosphere and NOAA Deputy Administrator

Vice Admiral Lautenbacher (Undersecretary of Commerce for Oceans and Atmosphere) couldn't be present at this meeting, but he wanted to send the message that stewardship in our nation's governance of its national resources is key to our mission today. We need to "take the temperature of the earth," in order to manage earth systems and to make correct decisions for future generations. In order to do this, more and better measurements are needed.

The unique history and role of the COOP network has been an example of the best of public service. Many thousands of citizens have taken measurements and reported them for the benefit of our nation. COOP has played a key role over a long period of time. Now we want to modernize it so that it can take on an expanded role and add to our vision of an end-to-end monitoring program that "takes the temperature" of the earth's systems. Resource management issues often exist on a small scale. These include health of ecosystems, population density, industrialization, coastline development, transportation systems, and agriculture. (The U.S. leads the world in food production.) All of these issues are critically linked to climate and weather.

The proposed modernization of the COOP network has the potential to fill in data gaps on the small scale, where much of the decision making takes place. Many state and federal agencies, local interests, and the academic community need such information.

We rely on the private sector and media representatives to carry our message on the role of science and measurement. Many future applications or uses of the COOP data will come from the private sector, and the focus we place on the COOP network will be validated by this use.

Improved observations will result in better analyses and forecasts. Let's honor more than a century's worth of efforts on the part of observers and all their contributions by building on this program so that it can do even more in the future. It will contribute to our understanding of ground truth on the scale that we live.

At the core, the COOP network is voluntary. The public sector and the private sector are partners. For example, we in the public sector rely on the media to deliver forecasts and information. We are partners, yet we each have our own special mission. Private sector companies have the special role to develop data and to provide goods and services for society in the best market tradition.

Improvement and upgrading of coverage, including filling data gaps and moving toward real time reporting of certain parameters, are part of NOAA's goal to provide end-to-end coverage. NOAA is also developing and implementing a Climate Reference Network (USCRN). At only 220 stations, these sites will be sparse relative to the COOP network, but they will provide anchoring (calibration) for COOP. Manned and unmanned buoys, and satellite information, are all part of our end-to-end vision. Validation of small scale information will be at the core of resource management in the future. The U.S. will provide leadership in this area. Secretary Evans is eager to see the Administration's climate analysis program address problems on global and local scales, and he is exuberant about the COOP program. We view this meeting as a very important step and look forward to collaboration in the modernization of the COOP network.

Modernization of COOP

Dr. Kenneth C. Crawford, Director, Oklahoma Climatological Survey, and National Research Council's Panel on Climate Record: Modernization of the Cooperative Observer Network

"Modernizing the Cooperative Observer Network: An NRC Perspective and an Oklahoma Perspective"

Where have we come from over the last 100 years? The following summary is the essence of a 1998 NRC (National Research Council) study, with a little Oklahoma flavor. Three members of the Panel on Climate Record: Modernization of the Cooperative Observer Network are present in the audience. The study looked at applications of data from the COOP network, and assessed how to continue and modernize it. They identified actions that should be taken to strengthen the network and made twenty-two specific recommendations.

The network archives are of exceptional value, really a goldmine providing one of the most comprehensive records available. In the past, no one could have known how many applications lay ahead for this weather and climate network, which is well suited for monitoring climate change.

Some problems were identified. A major one is that the current network cannot continue at the present funding level. Another problem is that the instruments used in the network have not changed over the last 100 years. The policy running the network was inconsistent over time and the panel found that it was not obvious who “owns” COOP and is the steward of the network.

In terms of recommendations, the panel called for NOAA (NWS and NCDC) to improve management of the project. NOAA must partner with other agencies and guide the network into the future. In general, there was a call for improvement in network technology, including automation of site communication as well as the gradual addition of data loggers, sensors, and computers.

In the U.S., many local and state networks for observing the weather are appearing. These could supplement, but not replace, COOP. NOAA should work with other agencies to create data composites. The general recommendation was to modernize and upgrade the network to get it ready for the 21st century. This meeting is a direct response to the recommendations that have been made.

The COOP network has great economic value. For example, COOP data has played a role in some expensive lawsuits. Because any errors in the data can complicate legal proceedings, even minor errors are important and must be avoided.

Kelly Redmond (Western Region Climate Center) processed thousands of requests for information made during the 1980s and 1990s, and he identified over 300 distinct applications of COOP data, much of it climate related, which demonstrates its significant economic value. There will be “big bang for the buck” in automatic data collection, as it will open up many new economic opportunities.

In Oklahoma, COOP provides so much value for so little expense. There are some things that are within our control to change, and this would improve the network. We can control the intervals at which we collect data. Current intervals are not adequate to meet demand. We can provide calendar-day extremes, which are needed, but currently not provided. Another thing we can control is a bad practice which is non-uniformly applied, the subjective shifting of daily extremes to be more reflective of the “date-of-occurrence.” There are also big inconsistencies in the quality and representativeness of the observing sites, which can be corrected.

COOP data is the only official record of climate in the U.S. and it provides context for extreme events such as drought and flood. If we modernize, we need to ensure continuity of the long-term record through a period of overlapping measurements between old and new instrumentation. There will still be a role for human labor, for example, in reading snow depths.

Smaller and smaller scale meteorological models are being developed. How do we verify these without data? We need to be able to validate these and the COOP data stream will

be useful. In addition, COOP would help with the validation of climate prediction models.

Local mesonets cannot replace the COOP network. COOP is essential for tomorrow's world and the mesonets are a supplement.

The NWS has the opportunity to establish what it wants for observation standards and their leadership is required on this matter. Stakeholders also must be kept in the loop. As we modernize, we need to document metadata.

Oklahoma mesonet became well established within 10 years and its use is increasing. When an accident occurred which caused the I-40 bridge to collapse in eastern Oklahoma (May 26-30, 2002), weather data played an important role in the recovery effort, and the mesonet delivered critical information to users. For example, the reconstruction workers used temperature data to pour and set concrete efficiently, so that the job was completed ahead of schedule.

The following "five strong pillars" were identified in the NRC's Climate Services Vision Report, 2001. The blue ribbon panel believed the Oklahoma Mesonet's success was built upon these pillars:

- Users were involved from Day One.
- Products were developed in direct partnership with users.
- Strong partnerships existed with mission agencies and with research elements.
- Information was accessible in real time.
- Education of users and potential users was an important element of the program.

These "pillars" can be applied to COOP. NOAA has the opportunity to build a modernized system that will enhance the well being of the nation. These recommendations are not difficult or expensive.

Comments, questions and answers:

Question: In some states, a mesonet has replaced COOP. Sites are located at COOP station points and mesonet automated equipment took over. Because this change was often not noted, in many cases the record is contaminated. This probably occurred because NWS field offices set a low priority on COOP. How can we overcome this in the future?

Answer: This did not occur in Oklahoma and it should not be that way in other states. We must educate others on the importance of this system and not give up until they understand. There will always be violations, but we must do our best to prevent this.

Comment (Peter Corrigan): We are very interested in the health of COOP. There are 144 COOP stations in central Iowa and we work hard to keep the network running, but we need the higher authorities to push the program.

Response: We must claim victory and not let opportunities go. We must not listen to skeptics, but rather win them over.

National Weather Service (NWS)

Brigadier General John J. Kelly, Jr., U.S. Air Force (Ret.), Director, National Weather Service

It is not the role of the federal government to lecture, but rather to let you know what we are trying to do and to get your frank comments and input. Data is not a high priority in Washington or the budget process and we need to accept this reality and collectively deal with this fact.

In the COOP network, we have a jewel involving 11,000 citizens of this country. Unfortunately, the technology we give them is at least 50 years old. Observations are recorded on paper and sent in by mail, ultimately arriving at NCDC. Modernization of this network is something that we can do. This is not putting a man on the moon. We can take a reasonable, best value approach, and have a network that is reliable and durable. If we do nothing but improve the data collection using standardized technologies that provide timely availability of observations, that would be a major improvement. We need standard data formats for multiple users and many applications.

Although we may think that we understand requirements, we need meetings like this to help determine what they really are. The modernized network will be standards-based, and it will be modular in design, allowing for continual evaluation and evolution.

What do we want to do? We want to improve the layout and density of observation sites to correspond to a 20 mile by 20 mile grid. We want to improve time resolution to an hourly basis. The federal role in this is to be neutral broker of the data, to insure that the data are secure and that they are not tampered with. We also want to improve data access for all users.

The improved COOP data will allow the NWS to improve forecasts. Dr. Mahoney, Tom Karl and their successors will have better data to study climate variability and change, while all others will have better access to data.

NCDC will work to find the best locations for sites. Temperature and precipitation information will be recorded hourly at 8000 stations. At about 6000 stations, snow will be measured manually. We must work with the climate community to establish their requirements. This is truly a multi-use network.

We must try to address NRC recommendations. We are rich in data but poor in data sharing networks. For example, the USDA has soil data, which could be included in the network. We must work with State Climatologists and regional and state WFOs on quality control of data.

In summary, there will be improved data at 8000 locations across the country and this will improve the ability of NWS to forecast weather and extreme events such as flood and drought, providing improved information for decision making.

Comments, questions and answers:

Question (Barry Myers): The NRC 1998 report addresses the attempt to automate. Tell us a little more what the plan will look like.

Answer: Data collection protocol will upload to GOES, then download to forecast offices or NCDC. My expectation is that the data will flow in real time.

Question (Floyd Hauth): Do you have, and can you sustain, the funding needed?

Answer: It's a challenge. The modernization will take about 12 years, at best, in view of the present budget scenario. The government is in deficit spending and the country may be going to war. Are there alternative ways to fund this? We have been fortunate in the past 5 years, but I can't forecast the future and the ability to sustain. In any case, we are committed to working to get it done.

Question (Jeff Schultz): Will station density be adjusted to correspond to population density? For example, at this time, New York City has only one station.

Answer: The basis for the station locations will be scientific. The 20X20 mile grid is not based on population. We have had a study to determine the best locations and we want to avoid introducing discontinuities by, for example, changing the location of established stations.

Question: Wasn't placing two stations per county a suggestion?

Answer (Bob Leffler): Although the study plan called for a 20X20 grid, there is some flexibility, so there will be an increased number of stations placed in places with large temperature gradients, such as urban and coastal areas.

Closing comment (Jack Kelly): Remember that it is difficult to sell data in Washington. We are really just trying to do a modest upgrade from a 50-year old technology.

COOP Modernization Proposal and Benefits

Chair: Mr. Samuel P. Williamson, Federal Coordinator for Meteorology, Office of the Federal Coordinator for Meteorology

“NOAA COOP Modernization Proposal & Benefits”
Mr. Rainer N. Dombrowsky, Chief, NWS Observation Services Division

Over the last year or two, we have made progress on educating the public and partners regarding COOP. Where do we want to go with the program? We want three-county resolution and optimal special distribution. We want to improve drought and climate monitoring and fill gaps in coverage, especially in the West and Alaska. In addition, we want to automate the network to get a better picture of temperature.

We also intend to improve data availability. Most improvement will be in the addition of data loggers and telecommunications. There will also be the availability of on-site quality assurance like ASOS (Automated Surface Observing Systems), and data will then go to NCDC for final quality control. Modernization will make it possible to get data out faster than in the past.

There are only about 1500 snowfall monitoring sites right now and these will increase to 6000. We have come up with ways to integrate two radar precipitation estimates with COOP data to get better precipitation estimates. Temperature forecast error will also be improved. An example in Florida shows how improved temperature information can be a critical mitigation tool for potential crop damage from low temperatures.

There will also be applications for improved flood forecasts. In placing sites, we need to consider the population density, user requirements, and the locations of rivers basins. We might put an additional site in an average basin to see how much we could improve on overall error. In at least one instance, we know that error could be reduced by 40 %, which would fill both operational and climate needs. Modernized COOP will also provide accurate real-time information during other critical situations, such as forest fires.

Temperature and pressure gauges at locations identified in the spatial density study will be modernized. NWS forecast offices will engage with users to find how many stations need to be upgraded. ASOS and other networks (such as SNOTEL) which meet the minimum standards requirement will be hourly and distributed to all users.

Improvement of spatial density in the West and Alaska is imperative. USDA will work with us so that soil moisture and other data sets will be added. The dissemination of data will go through a central system and an internet approach is being developed.

The COOP observer is the lynch pin. They will allow this equipment on to their property and into their homes. They will have interactive data terminals. Satellite micro-burst and other technologies will be explored. Currently, the climate data are received at NCDC at varying times from one day to two months after the end of the month. Only a small amount come in by telephone, and the remainder, coming in as hardcopies, may take up to two months to arrive. As a result of modernization, the data will be available on an hourly basis. Improved drought monitor resolution will go from its present ten-county resolution to a three-county level.

The 24-hour temperature forecast error should improve by 1.5 degrees as a result of the improved site spacing, which will improve the forecast models. A one degree improvement will have a positive economic impact for the energy industry, allowing substantial savings.

Details of the 2001 COOP network spacing plan are available. This will be a lengthy, budget driven process which is expected to reach steady-state operation by 2012. Input from this meeting is critical to us. We want to establish an integrated work team.

Comments, questions and answers:

Question: How about some details on technology?

Answer: We are now putting together final requirements and looking at the budget. Systems are very expensive, so we haven't made final determinations yet. We are hesitant to move forward with the tipping bucket because it is not an all-weather approach. Our goal is to meet minimum user requirements while working within budget constraints.

Question: How much did the New England demonstration project cost?

Answer: - One year's funding was about \$3M for temperature and \$3M for air quality. In looking for the ability to integrate many different systems, a broad range of techniques was used. In the Southeast, we are looking for about 200 platforms, but we haven't been able to define the "Southeast" yet. We want to focus on a single state to see how well the upgrade will work across that particular region.

NOAA

"A Perspective from the National Climate Data Center"

Mr. Thomas R. Karl, Director, National Climatic Data Center

Creating a vision and looking on the positive side is important. We have a vision to get the COOP modernized. COOP is a national treasure, and we can't let this opportunity pass.

At NCDC, the most requested data is that of COOP, so this network clearly has extreme national importance. We recently digitized all the historic hardcopy data, which meant a big improvement in the availability of digital data. An important part of the COOP network is the high resolution precipitation data needed to evaluate flooding, stream bed erosion, and surface runoff. An example of a COOP-related product put out by NCDC is the climate atlas, now updated and on CD-ROM. This could not be done without the COOP network

COOP data have many applications. For example, they are used to understand temperature gradients. Other applications include defining climate normals, maximum

and minimum temperatures, precipitation, snow fall and snow depth. They are used to answer the questions: “How cold? How warm? How dry? How wet?”

An example of a joint product that could not have been created without COOP is the plant hardiness map, which is produced in conjunction with USDA. This is an extremely useful product that is printed on packs of seeds.

Another example of an application of COOP data is by the National Homebuilders Association. An air freezing index has been developed, and new standards have been published describing the amount of energy that can be saved annually just by changing standards on foundation footing. Estimated savings are \$200 million/year.

There has been great progress in data storage and access between 1950 and today. We now have a mass storage system with instant access. In the past, the paper forms for reporting COOP data have sometimes been unreliable, because an observer always needed to be there. With the automated system, this won't be a problem. In the past, forms sometimes arrived late and missed the quality control cut-off; the result was that data from some sites was unavailable.

The COOP network is an important work partnership for monitoring climate change. In our effort to understand climate variability and change, we plot maximum and minimum temperatures and best estimates for precipitation, which indicate that the last several years have been dry. These plots use the best sites, although they can have issues and inconsistencies. Transfer functions have been developed to derive the best information from the existing network. Looking toward the future, we have a shared vision of using the new U.S. Climate Reference Network (USCRN) in conjunction with the COOP network to answer the question: “How has U.S. climate changed over the last 50 years?” The USCRN will compliment COOP and transfer functions will be developed for the full network. The primary focus of COOP is temperature and precipitation data, and the USDA may also install soil moisture

Because the climate change issue has a strong science and research component, we want the USCRN locations placed where there will be no encroachment of human activities. A key aspect of the USCRN will be network performance monitoring. The establishment of back-up or complimentary stations is important because there can always be mechanical problems, so this is a critical component. These reference stations will pick up errors not noticed in the past. An increased density of stations will help us to understand what's happening at the local level.

Comments, questions and answers:

Question: There was a big spike in COOP records during the 1940's. What is the reason for subsequent erosion of numbers?

Answer: It was hard to maintain all the stations because of the budget.

Comment from Jack Kelly: It was not a budget issue. What's really needed are dedicated people. Observers must perform their duties twice a day. We have a different society now than in the 1940s, with less of a service ethic. We could sustain more observers if we could get them. The proposed automation would reduce the onerous tasks that we ask observers to perform. Budget is not the issue, as these sites are not expensive. What we really need are people who are willing to do the job.

USDA

"USDA Support for COOP Modernization"

Dr. Gerald A. Bange, Chair, World Agricultural Outlook Board

The Cooperative Observer Network (COOP Network) was established in 1890. It is the nation's largest and oldest weather network, serving many agricultural purposes. The Department of Agriculture, which I represent, has a long and proud tradition with the National Weather Service dating back to 1890. In 1890, the Weather Bureau was transferred from the War Department to USDA where it resided for nearly 50 years. In 1940, the Weather Bureau was transferred to the Department of Commerce. Despite this change, the importance of weather observations for agricultural purposes has not changed. The COOP Network remains the backbone of our domestic weather analysis infrastructure.

COOP data are used for a wide variety of governmental and farm management purposes. The COOP Network is an invaluable source of weather records for the *Weekly Weather and Crop Bulletin (WWCB)*, a joint Commerce/USDA publication. The *WWCB* has been published since 1872. It is widely used by farmers to make decisions with respect to livestock management, planting, chemical applications, and other cultural practices. This information is also used by USDA to monitor growing conditions for crop assessment purposes. It provides timely weather and crop information between the monthly *Crop Production* and *World Agricultural Supply and Demand Estimates* reports issued by USDA. As such, the *WWCB* is one of the key indicators used by world commodity markets.

From a longer term perspective, the Network provides a unique source of historical information. This is used extensively by USDA and others to identify analog years and for various research purposes. It should be noted that observations from the COOP Network are indispensable inputs to the *Drought Monitor*, a product which is widely used by policy makers, the media, and others.

The density of reporting stations within the COOP Network is of utmost importance to agriculture. Thus, USDA is concerned about its future. One disturbing sign is the roughly 15 percent decline in the number of COOP Network stations from its peak in 1972. Demographic shifts including a reduction in the number of small farms and population shifts toward the coasts and cities have made it increasingly difficult to recruit and retain volunteer observers. Thus, the largest declines in the COOP Network have been concentrated in rural agricultural areas.

USDA strongly supports efforts to place modernized and/or additional COOP sites, especially in agricultural areas that currently have limited coverage. NWS has indicated that the modernized COOP Network will incorporate the requirements of agriculture, including agrometeorological measurements, network density, site location, timeliness of data, quality control, and reporting procedures. These requirements form the essential framework from which weather and climate information can be used by USDA and any other data users to meet the diverse needs of agriculture.

As an indication of solid support, NWS requested USDA to seek funding ear-marked for the NWS COOP Modernization Program. Despite numerous other priorities and limited funds, I am pleased to report that USDA will include \$1 million for NWS in its FY 2004 budget submission to OMB.

USDA looks forward to working with NWS on this valuable project which will benefit farmers, agribusiness, government, and the research community.

Media

Mr. John B. McLaughlin, President, National Weather Association; Board of Directors, American Meteorological Society

COOP data is the forgotten stepchild of surface data. The Iowa mesonet is in a partnership with media, transportation, ASOS, and COOP. We put in 44 stations that disseminate real-time data. The usage has been tremendous and has generated very visible rewards. In local communities, some stations are located at schools. This system can show weather changing while it happens and relate it to radar. This real-time data is used to correct estimated rainfall and to adjust NEXRAD. These data can be put on the internet and anyone can track changes as they occur.

Now that we have all this data, what can we do with it? An example of an application is an automatic alert for a 50 mph wind gust. Data are archived every 2.5 seconds, a time scale at which we can see a heat burst, coincident with high wind. Another example might be an alert for a change in wind direction. These alerts go out to the weather service. We have about 160 stations online and all the data are in GIS format. We need instant access to data and quick applications in which these can be analyzed and presented graphically.

The good thing is that we are supplying information to the public. We have tried on a local level to help TV stations and the public. We are combining data into useful information, essentially taking nuggets from the COOP data. The National Weather Association supports this modernization effort.

Comments, questions and answers:

Question: How is QC handled?

Answer: It's based a lot on AWOS (Automated Weather Observing System), and we look for anomalous sensors.

AFTERNOON SESSION

Keynote Address

Speaker: Deputy Secretary of Commerce, Samuel W. Bodman

One of the best parts of my job, as Deputy Secretary, is running the operations at Commerce. It is a diverse department and my primary obligations are to its employees and the public which we serve. No day goes by when I don't learn something. I just recently learned about the COOP network. Like most citizens, I wasn't aware of it.

Secretary Evans and President Bush both believe that we can all personally play a role. In Commerce, our role is our stewardship of the free enterprise system and of natural resources. We in government are short on resources to carry out many of our missions and the great range of things that we are asked to do. Cooperation among federal agencies, state, and private interests is important. It is crucial in getting things done.

In this program, we have obtained an unequalled record of climate through the efforts of thousands of citizens over the years. These are people from all walks of life. The list is long and includes both retired and working people. Stations are located at mountain resorts, beaches, prisons, monasteries, and zoos. This was all news to me, and I was struck by the extraordinary dedication of the observers.

The COOP network is the personification of the President's vision to mobilize volunteerism in this country, especially as a result of the fallout of 9-11. The Vice President is often shipped off to undisclosed locations from time to time, and so are the officers who could ascend to the presidency, including the Secretary of Commerce. Because of this, I often fill in for Secretary Evans at Cabinet meetings and so I have considerable contact with the President.

President Bush is very focused on the issue of volunteerism. He believes in decency and kindness, and in his own way he personifies it, but so do the COOP observers. In donating their time, they have contributed to the welfare of the country. Let's give a round of applause for the observers in this room, and also for their relatives and friends who carry on in their absence.

We are here today to talk about plans to modernize the network, and we are eager to hear comments from you on the plan that has been described. Proposed improvements include increasing the density of stations in the West and Alaska, and worldwide dissemination of data.

The modernization of COOP is related to the President's climate change initiative. Dr. Mahoney has been charged with analyzing research projects undertaken by the

government. The COOP program would play right into this. Climate change is very important to the administration and Jim (Mahoney) has the lead.

We need a richer source of data to improve weather and climate forecasting and to contribute to climate change research. We will all benefit from this. The value of these data is hard to quantify, but about one-quarter of the U.S. economy (\$2 trillion) is weather sensitive. Reliable weather forecasting is crucial, for example, in obtaining energy industry savings. Those in the industry need to know much fuel to commit ahead of time, as there is a huge penalty for undershooting. This is one example of how reliable information will help us to manage our affairs better, having a positive economic impact.

The COOP network is a gold mine of data that has been used in millions of decisions. People not in the meteorological community assume that the needed data will just be available. In Commerce, we see increasing demand for weather and climate data.

In my position, I don't have the opportunity to travel much, but I will be in North Africa next week. Many countries have consulted with NOAA regarding drought and flood recently. In the U.S., there is \$13 billion in property damage and 80 deaths per year related to drought and flood. The modernized COOP will provide data that will help manage these extreme events. An Interim Drought Council was created to mitigate conditions based on COOP data. We need to improve data services and to move ahead with new technology in order to meet needs both now and in the future. This project will take more than a decade to complete. We will pursue funding, but we ask that those outside of government think about the impact of this program and see if there isn't justification for contributing additional funds to accelerate this. If money were no object, the modernization could be implemented in 3 years. Improved temperature forecast error, from 3 to 1.5 degrees, would alone be a strong case from a business standpoint.

Thank you all for the terrific job in creating this network of people that exists throughout the country. The COOP network is truly an example of what should be done in other sectors of the country.

Comments, questions and answers:

Comment (Floyd Hauth): I want to suggest a trust fund of some sort on insurance. This would give COOP more stable funding.

Response: Thank you for the suggestion.

Question: Is there a link to the President's Clear Skies Initiative?

Answer: We are at the beginning of a system to manage carbon. I would want to make them aware of what goes on here. COOP is not generally known. This is probably because the NWS is a technology-based enterprise and not promotionally oriented. We need to get broader attention and we need a broader understanding of what we do. NASA's budget is about 15 times that of NOAA. We spend about 15 times more to

understand the heavens than we do to study our own planet. We know more about the backside of Venus than we do about the bottom of the Atlantic Ocean.

Question: What can we, the data providers, do to help accelerate the process?

Answer: I am precluded by law from encouraging anyone to lobby. Having said that, the fact is that Congress is the ultimate source of decision making for initiatives. A broader understanding of this network and its importance in the legislative branch would be beneficial.

COOP Modernization Proposal and Benefits (continued)

Chair: Mr. Samuel P. Williamson, Federal Coordinator for Meteorology, Office of the Federal Coordinator for Meteorology

“Partnership Options”

Mr. Glenn E. Tallia, Senior Counselor for Atmospheric and Space Services and Research, NOAA

There are legal options available to address both upgrading an old COOP site or establishing a new site.

Option 1 - USG equipment on a privately owned site can be covered by a written agreement, which grants approval to install the equipment, addresses liability issues, and states “who pays for what.” We have about 25 of these agreements in place, which essentially obtain permission from the landowner for us to operate on their site.

Option 2 - Non-profit entities can jointly fund and operate a site with equitable apportionment of costs.

Option 3 – A gift can be made to DOC/NOAA. We can accept gifts of equipment and instruments to do our work, subject to conditions. For example, there may be approval requirements. A gift can’t be accepted from someone with a conflict of interest. We must avoid problems of association and not tarnish the agency’s reputation.

A good public/private partnership model is NOAA weather radio. The approach was to accept the gift of a transmitter, but there was a signed agreement to operate and maintain it. This has worked great and is very successful. It has been a good way to get transmitters up and running where needed.

Data sharing is another issue. Private parties provide data from their network to NOAA using a written agreement. A lot of the time, we get condition-free data, but sometimes there are restrictions on use. This is more of a policy issue than a legal concern.

Comments, questions and answers:

Question: What if a COOP observer is injured as a result of observing? Is the government liable?

Answer: That's a tough question. Generally speaking, we expect private partners to have the same protection for their employees, although in some cases our protection may carry over.

Question: How long are agreements?

Answer: They are typically fairly short, on the order of 3-4 pages, and with fairly standard terms.

Question: When you have data sharing options, who makes the decision?

Answer: NWS management or office of policy. There is not one person. My office offers legal advice. Our preference is to obtain data without restrictions.

Question: In option 3, are there any other examples besides NOAA radio?

Answer: It's the only specific example that I can think of. It is somewhat novel, although the law allows us to pursue that approach.

Question (Nolan Doesken): In Colorado in the last 30 years, we have had automated weather stations donated to the university. It's feasible that many would provide equipment. Are you prepared to accept such donations?

Answer: The head of the agency has to make that call.

Question: Are there liability issues of which we should be aware?

Answer: In general, in the meteorological area, it is hard to be held liable. But there are exemptions in the law, so I can't give a blanket answer. Each case has to be looked at individually.

Question: Any cases of an individual COOP being sued?

Answer: I don't know of one.

Western Governors' Association
Mr. Shaun McGrath, Program Manager, Western Governors' Association

I met with Admiral Lautenbacher about a month ago, examining how to partner with NOAA, and will meet with General Kelly next week. We recognize the potential here.

There are eighteen governors in the Western Governors' Association. The organization was created because a lot of Washington D.C. policy does not serve western interests.

We lack the population to get enough clout. So we created a bipartisan organization to present western interests. We operate by consensus and carve out the middle ground on issues.

We have a history of work on drought and drought policy. In 1996, during the southwestern drought, we created a drought working group. Governor Johnson from New Mexico was frustrated. Local interests came up with recommendations, which the governors adopted, but a national policy is needed. At this time, only the Bureau of Reclamation has a Drought Relief Act.

Some federal programs haven't been workable. For example, in order to obtain funding for fighting forest fires, FEMA required paper work to be filled out coincident with the fire fighting effort, which didn't work well. It is best to get funding beforehand so that equipment can be in place before the fires start. In addition, in some cases, trigger mechanisms for response programs are not well coordinated. Drought monitoring is needed and data are inadequate for getting the full drought picture, and the time lag is a problem. The governors helped to get the Drought Monitor launched, which has been a big improvement.

The association also went to Congress and asked for a commission. The National Drought Policy action created a commission, which issued a report in 2000. A reconvened working group came up with a draft bill to create a National Drought Policy, which was passed last May. It calls for creation of a National Drought Council, which will be responsible for coordinating and integrating programs. Another element is the creation of a drought fund to assist local watersheds in developing drought preparedness plans. The idea is to get ahead of the game rather than just respond to drought when it happens.

We need to create a National Drought Network. Problems are to identify drought and to determine the response trigger. The Drought Monitor still lacks important data sets (for example, information on groundwater) and real-time data, which is key for monitoring. Other information, such as reservoir storage, is needed. We want to get to the point with data so that drought plans can be implemented as the event occurs. It is best to pull people together when water is abundant to talk about how a scarcity will be handled. We need to move to a position of preparedness and mitigation.

Comments, questions and answers:

No questions.

Panel: COOP Modernization Data Benefits

Moderator: Dr. Robert E. Livezey, Chief, NWS Climate Services Division

The NWS Climate Service Division is a champion of COOP modernization, and this meeting is part of that activity. Each of our panel members represents a key player. Three are members of the business community that leverages weather and climate data.

American Association of State Climatologists
“A State Climatologist’s View”

Mr. John M. Grymes, III, Past President

Louisiana has a typical state program, with a quiet, small group that is influential in the COOP process.

How important is the COOP to Louisiana? It improves data coverage from fewer than 30 sites to more than 200. SHEF (Standard Hydrologic Exchange Format) sites give a better handle on climate. We try to use resources at Louisiana State University to provide data. The state climatologists can join with the NWS to provide services and try to provide users with real time data. In Louisiana, we have more than 100 USGS rain gauges. These are valuable for real-time monitoring, and now we are cooperating with them and providing data quality control. Products are developed from SHEF data. We can provide raw data and data analysis in a few hours for assessment. For example, in one case, we answered questions such as: “Is there a mini drought?” and “What is the effect on agriculture?” We also use these data to QC (quality control) the NOAA data in the state.

We have access to the user community. Relative to WFO staff, we have greater stability, so we have developed these long term relationships. We would like to strengthen and formalize the links between Recognized State Climate Offices (ARSCOs) and NWS WFOs. We have expertise at the local level.

It will take at least 12 years to complete modernization. There is a good array of data available in near real-time already, but we must make these more readily available to the user community. Modernization is about culture and people, not just about forecasting. It is about client services across the country. It is a low cost way to improve climate services.

Energy
“The View of Electric Utilities”

Mr. Roger Kranenburg, Director, Business Development, Edison Electric Institute

The energy industry is very temperature-sensitive. An example is what happened during the recent energy crisis in California. We use temperature data for load forecasting. Think of energy like a transportation network. Precipitation is a second order effect in load forecasting.

Snowfall and snow depth data are used for estimating hydroelectric reserves, especially in the West. For example, it’s a problem in California when there is not enough water in the reservoirs. Long-term precipitation forecasts would translate into useful information for planning hydrologic resources. Unfortunately, most stations are close to airports, not

dams. We need stations closer to dams. Short-term forecasting can be refined with real-time data to make better predictions. Timing is important. Current models can be adapted to absorb the real-time data.

Now that I know more about the COOP modernization, I want to change my original opinion that it is a “good idea” to it is a “great idea.” One degree of improvement in temperature is worth one billion dollars.

Weather Risk Management Association
Ms. Lynda Clemmons, President

The Weather Risk Management Association (WRMA) represents 80 companies from 12 countries. We are concerned with the financial impact of weather on businesses. I travel all over the world talking to meteorology agencies in an effort to obtain their data. Some of these are more technically advanced than NOAA, but NOAA is the most responsive of all the agencies that I have worked with. NOAA is trying to be pro-community.

Daily data are critical. Daily weather data for us are the same as daily currency exchange rates for the financial community. Weather is very important, as it has \$2 trillion worth of impact on the USGNP. For example, it has a large impact on retail performance, and this is a sector that usually is not represented at these meetings. There are opportunities to help this sector use weather information beneficially.

Another example is a municipality in the southwestern U.S. that wants to protect itself in the case of too little rainfall. Under such circumstances, they must buy extra power from the grid. COOP stations are very important, but there are gaps in the data. Consequently, these data are not good enough for us to price a product. Modernized stations with continuity are critical. WRMA would be delighted to access timely and accurate data for our members.

National Drought Mitigation Center:
“The Role of COOP Data in Monitoring Drought”
Mr. Mark Svoboda, Climatologist

Key variables for monitoring drought include climate data. Drought is a hard sell. We try to monitor and mitigate. A key to mitigation is early warning. For this, information must be received in a timely manner. From an operational standpoint, COOP data that can supplement soil moisture are number one.

Information for the 344 climate divisions is routinely run through the drought indices. It's important to get timely data with a high degree of spatial resolution. We calculate drought indices from COOP data and in near real-time in SHEF (Standard Hydrologic Exchange Format). Users can access the information for each state. We are getting closer to a three-county resolution spatially. We do weekly plots and we can now generate a suite of maps in 10 minutes, a task which used to take a week or two.

Timeliness of data is key, and we need to fill in data holes. Modernization will help in both these areas. The COOP network is important for preserving the past and monitoring in the future.

A North American Drought Monitor product will debut experimentally this fall. There is a lot of interest in taking the Drought Monitor to a continental scale.

Private Meteorologists
Mr. William Bradbury, President, Weather Factor

Weather Factor is 14 years old and it serves national consumer product or service marketers. We look at which of their programs are making business grow and which aren't. Product sales often have a strong dependence on the weather. For example, people don't shop on cold, wet, windy days for a house or a used car.

We want to identify the weather factor in volume trends in order to de-weatherize those trends. Econometrics correlation and regression lies at the heart of our analyses. We focus on weather impact on volume. The key impact of weather is primarily on a day-to-day basis. It might be a little warmer or a little wetter this year, and for example, if it's a little warmer, people will drink more beer.

To accommodate this, we have LCD (Local Climatological Data) for 117 cities, and we want 100% accuracy. We produce a monthly publication, which summarizes hourly observations. We divide the area into markets containing one or more cities, but weather can be diverse in these. Population is important, as we weight by population, not area. We need to know the conditions in the urban centers. Our unique database aggregates on an hourly level. A standard database for our purposes is of day-time precipitation, from 6:00am to 8:00pm. A charcoal briquettes company was interested in the period from 4:00pm to 9:00pm, so we customized an aggregation for them. We have found that a 5 degree difference in temperature, relative to a year ago, affects sales. Our clients say that this relationship gives the strongest weather-related correlation.

How can you help? LCD stations are not located in populated areas. We need accurate reports for cities, where temperatures can vary over a few miles. For example, in San Francisco, there can be a 10 degree change in 10 miles. Stations that represent cities well would benefit us.

The ASOS (Automated Surface Observing Systems) program has problems, and the FAA can't provide a backup when equipment fails. Another problem is that snowfall measurements are taken at different points than precipitation, so we have to triangulate and correlate to fill in holes. The modernized COOP could provide the needed data.

Three things need to happen:

1. We need locations in cities.
2. We need to get timely, accurate, complete data.
3. Data should be collected automatically and distributed on a timely basis.

Regional Climate Centers
Dr. Michael J. Janis, Director, Southeast Regional Climate Center

NOAA's Regional Climate Centers (RCCs) and their constituents regularly use the weather information collected by cooperative observers. This information serves a multitude of functions in agriculture, business, energy, and other economic sectors. This information is the primary source for monitoring climatic conditions over weekly to annual time frames. COOP data are also the basis for assessments of century-scale climatic change and variability.

Though the longevity of COOP is a testament to its importance, we believe there are additional metrics for a successful observing system. A successful observing program should allow citizens who take the weather observations – whether educators, farmers, or retirees – to benefit from the immediate use of these observations. For example, the observations need to be available for monitoring drought conditions as they are occurring. A successful observing program should maintain standards for observing, collecting, distributing, archiving, and documenting practices. A successful observing program should be cognizant of how its information is used in decision-making across weather-sensitive economic sectors as well as how its information is used by other federal agencies.

The RCCs would like to take this opportunity to offer some challenges to COOP modernization:

1. Daily weather observations are required for monitoring climate as well as many other constituent activities. The number of near real-time weather stations does not currently meet the user demands in several locations of the United States. Increasing the number of near real-time weather stations and improving the dissemination of weather data in standard formats should be a key objective for COOP modernization.
2. While identifying locations for modernization, COOP management should consider NOAA's spatial requirements as well as the requirements of its constituents. In addition to maintaining long-term weather stations, factors such as the distribution of weather-sensitive economic sectors, the location of natural resources, and the spatial variability of climate fields may be worth taking into account.
3. Local site characteristics, instrumentation exposures, observing practices, and detailed metadata need to be key concerns for COOP modernization. Many studies have demonstrated the impact of inhomogeneities on assessments of long-term climatic change. Similar inhomogeneities can affect the spatial representativeness of weather data for operational uses in sectors such as agriculture. By carefully examining each weather station, COOP modernization provides a rare opportunity to ensure the integrity of weather stations across the United States.

4. Pursuant to the previous point, any changes made to the instrumentation systems should be accompanied by parallel testing at each modernized COOP station. The recommendation for parallel testing also applies to other weather station changes such as changes in observation times and station relocations.
5. The Cooperative Program should be well versed in the information requirements of its constituents. This outward-looking agenda can be accomplished through NOAA agencies and through regional and local partners, such as the RCCs and State Climate Offices. In other words, understanding the customers' information needs relies on an open dialogue through established lines of communications beginning with this forum and continuing well beyond modernization.
6. There are many examples of obvious data inaccuracies that become established in the "final" quality-assured national databases. Sometimes these occur because of breakdowns in various feedback loops within NOAA. We strongly encourage NOAA to pay closer attention to the overall performance of a modernized network and build feedback loops to actively pursue and rectify problem areas.

To summarize these points, we recommend:

- #1 deploying more real time stations,
- #2 improving the spatial coverage of real-time stations, especially at higher elevations and in the western United States,
- #3 narrowing site requirements, such as open sky views and distance from heat and moisture sources,
- #4 conducting parallel tests on new instrumentation,
- #5 learning more about the vast applications of the COOP data,
- #6 strengthening feedback loops both within NOAA and between NOAA and its partners.

In closing, we believe NOAA should continue to instill pride in taking good weather observations, collecting those observations, and caring for those observations. The real legacy of NOAA to the future is its data. Posterity is ill served by poor data, and this is our responsibility to future generations and to our heritage.

Open discussion:

Question: There is a lot of interesting information provided on the state level. Maybe we are approaching this the wrong way. The time table is 2010 or 2014. Can we wait that long? Maybe states should implement programs, and maybe we should just set standards and integrate what's out there:

Answer 1 (Jay Grymes): The network has to be at the national level. State boundaries are artificial; for example, rivers don't end at state boundaries. The lowest cost would be to work on the network that already exists. We don't need more mesonets.

Answer 2 (Bob Livezey): With the right resources, the time scale could be 2-5 years.

Question: Don't mesonets fill a need? Although, redundancy might be an issue.

Answer 1 (Jay Grymes): Coordination is definitely important.

Answer 2 (Ken Crawford): Good question. State economies are taking it very hard and budget cuts will eat into this. NOAA has proven that they can keep something alive for 100-plus years. Although, there's something to be said about the flexibility that states have that the federal agencies don't.

Comment (Bill Bradbury): States function well, but our companies are national marketers that look at the country as a whole. Some states will progress well and some won't. We need the same success everywhere.

Question (Steve DelGreco): Why not push daily phone call-ins, using voice recognition technology as an intermediate step?

Answer (Rainer Dombrowsky): We have been looking for a voice recognition system and also for funding to test this. We are also looking at other options, including technologies similar to those used by banks.

Comment (Bob Livezey): We must have a vision of some kind of system that will take science and service to a new level.

Comment (Mark Svoboda): We still only have 15 years of data in the Nebraska mesonet.

Comment (Joe Witte): TV weather stations know that there is a cry for local data. El Niño can be used as a marketing tool.

Question (Rodger Getz): What is the timeline on voice recognition? What's going to happen in the meantime to the existing network that needs maintenance right now, before we get to modernization?

Answer (Rainer Dombrowsky): Phase 1 of the COOP modernization plan addresses that issue and some activities are going on right now. There will be a marked improvement over the next year or so. Rescue was to be a separate issue, but we decided to fold everything into a single initiative.

Comment (Jim Angel): We use COOP data all the time. Its value increases from year to year. We get more phone calls, and products based on COOP data get thousands of hits. In the past, it was a true cooperative venture, and the individual had control of his station. What will happen if it becomes automated? Will the observers still care if the process is no longer "hands-on"?

Response (Bob Livezey): Let's let the COOP observers answer that.

Answer 1 (COOP observer, Bob Leffler): Automation will be a plus for me, because it gives me less to do, but I will have access to data. Some things will still be manual anyway, such as snow measurement, so automation is only partial.

Answer 2 (COOP observer, Nolan Doesken): A tipping bucket is good for rainfall rate. Although I have multiple gauges, they don't report the same value and I must come up with a "best judgment" value. I think that the COOP observers will be delighted with automation as long as they can access the data and compare it to other rain gauges that they may have. The human-involved gauge will put out better data.

Answer 3 (COOP observer, Sandra Hastings): I would enjoy the automated system as long as I could have access to the data. It would free me to go on vacation without arranging for a backup.

Comment (Bob Livezey): Backups will still be needed when a system fails, as it will.

Comment (Ken Crawford): I recommend to go all out for the automated process. A major payoff will be improved storm models. National leadership will give stability to the program.

Closing Remarks

Mr. Gregory A. Mandt, Director, NWS Office of Climate, Water, and Weather Services

COOP modernization will meet NRC recommendations and provide increased ability to forecast extreme events and to monitor drought and snowfall. It will provide data continuity, better data for decision making, and real-time availability.

We really want to capture the user themes. We need all of you, as partners, to make this happen. Here again are the five "strong pillars," which Ken Crawford presented in his talk as the basis for the Oklahoma Mesonet's success and which could be applied to the COOP:

- Users were involved from Day One.
- Products were developed in direct partnership with users.
- Strong partnerships existed with mission agencies and with research elements.
- Information was accessible in real time.
- Education of users and potential users was an important element of the program.
- Reaffirm importance of volunteer COOP observers.

We must build strong federal partnerships. Education and outreach may be the most important task within our own WFOs. Our goal for this meeting was to come together to think about how to make COOP modernization a success. Hopefully, each of you has identified your own role in this process and you will be leaving with your piece of the task.

NOAA has an opportunity to build a modern COOP system that can play an integral role in the nation's weather and climate networks and enhance the general well-being of the nation.